




Teachers' Digital Competence. The Case of the University System of Galicia

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ABSTRACT

The digital teaching competence of university professors is of vital importance to improving the quality of higher education, and for the strategic positioning of public universities in our country. The purpose of this study is to find out the level of digital competence of Galician university professors, as well as to identify whether there are significant variable-based differences. To this end, a non-experimental design with a descriptive approach and hypothesis contrast is proposed. The sample studied is made up of a total of 610 teachers from the three public universities of Galicia (Spain), who responded to the DigCompEdu Check-In instrument adapted to the Spanish context (Cabero-Almenara & Palacios-Rodríguez, 2020). In general terms, the results show a medium-low level and the existence of significant differences depending on the age, recruitment profile and area of knowledge of the teaching staff. Specifically, the younger teaching and research staff, together with Social and Legal Sciences, have a higher level of competence, whereas tenured teaching and research staff have a lower level of competence with respect to contracted workers. Therefore, training plans should be developed which focus on teaching. Expert advice and personalized methodological support should shift the focus of the intervention radically from technology to teaching.



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1 INTRODUCTION

Today, teachers' digital competence (TDC) in higher education has become a matter of growing interest in educational policy and research. This situation is the result of a double circumstance. On the one hand, the European Union considers TDC one of the key competences for the teaching-learning processes in the different European educational systems. On the other hand, COVID-19 has highlighted the limitations and needs regarding teacher training, infrastructures and technological resources that exist in different universities.

Digital competence and its development have become one of the main concerns in the university environment (Cabero-Almenara, Barroso-Osuna, Gutiérrez-Castillo, &

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Palacios-Rodríguez, 2021; Rodríguez-Hoyos, Gutiérrez, & Artime, 2021). The current educational scenario in Higher Education requires teachers to possess digital attitudes and skills that allow them to carry out dynamic and adequate, current and innovative work, which transforms and improves teaching-learning processes while making them more flexible. Digital teacher competence can be understood as an evolving competence throughout the professional career of teachers (Padilla-Hernández, Sánchez, & López, 2018), which goes far beyond using digital technologies (Durán, Prendes, & Gutiérrez, 2019). It is a competence that "teachers must possess to promote effective, inclusive and innovative learning strategies, using digital tools" (Redecker & Punie, 2017, p. 4). It also transcends the individual training of teachers in ICT matters (Casal-Otero, Barreira-Cerqueiras, Mariño-Fernández, & García-Antelo, 2021) and is shaped through the technical domain, the capacity for didactic application of technologies and digital media in teaching-learning processes, inclusion in professional development, and the ability to develop students' digital competencies (Esteve-Mon, Llopis-Nebot, & Segura, 2020). Although most of the research in digital teaching competence has focused on the pre-university level (Esteve-Mon et al., 2020), there is interesting literature which has furthered the study of the digital teaching competence of university professors (Bond, Marín, Dolch, Bedenlier, & Zawacki-Richter, 2018; Cabero-Almenara, Barroso-Osuna, Gutiérrez-Castillo, & Palacios-Rodríguez, 2021; Cabero-Almenara, Guillén-Gámez, Ruiz-Palmero, & Palacios-Rodríguez, 2021; Gromaz et al., 2007; Padilla-Hernández et al., 2018; Prendes, Gutiérrez, & Martínez, 2018; Rodríguez-Hoyos et al., 2021; Wang, 2021; Zhao, Llorente, Gómez, & Zhao, 2021). The literature reports that most university professors have a basic-intermediate level of digital competence (Cabero-Almenara, Barroso-Osuna, Gutiérrez-Castillo, & Palacios-Rodríguez, 2021; Cabero-Almenara, Guillén-Gámez, et al., 2021; Esteve-Mon et al., 2020; Santos-Lorenzo & Martínez-Abad, 2021; Zhao, Llorente, Gómez, & Zhao, 2021), and that their degree of knowledge is higher in the technical than the pedagogical domain (Esteve-Mon et al., 2020; Gromaz et al., 2007; Guillén-Gámez, Mayorga-Fernández, & Contreras-Rosado, 2021; Viñoles-Cosentino, Esteve-Mon, Llopis-Nebot, & Segura, 2021). The areas in which university professors perceive themselves to be more competent are those related to information and data literacy, communication, collaboration and problem solving (Zhao, Llorente, & Gómez, 2021), while they consider that they are less competent in the creation of digital content (Zhao, Llorente, & Gómez, 2021) and security (Trujillo & Flores, 2021).

Regarding the relationship between gender and the degree of digital competence, there is no consensus in the scientific literature of recent years (Cabero-Almenara, Barroso-Osuna, Gutiérrez-Castillo, & Palacios-Rodríguez, 2021). Consequently, certain studies reveal the existence of significant differences in favor of male university professionals (Grande-De-Prado, Cañón, García-Martín, & Cantón, 2020; Orozco-Cazco, Cabezas-González, Martínez-Abad, & Abaunza, 2020; Zhao, Llorente, Gómez, & Zhao, 2021), while other research does not reveal these gender differences (Basantes-Andrade, Cabezas-González, & Casillas-Martín, 2020; Cabero-Almenara, Barroso-Osuna, Gutiérrez-Castillo, & Palacios-Rodríguez, 2021; Cabero-Almenara, Barroso-Osuna, & Palacios-Rodríguez, 2021; Guillén-Gámez, Mayorga-Fernández, & Bravo-Agapito, 2021;

Trujillo & Flores, 2021). It has also been found that there are significant differences among female teachers, depending on age and fields of knowledge (Cabero-Almenara, Barroso-Osuna, & Palacios-Rodríguez, 2021).

The research also reveals that there are differences in the level of competence of university professors relative to the area of knowledge to which they belong. Thus, teachers in the areas of Engineering (Orozco-Cazco et al., 2020), Architecture and Legal and Social Sciences (Cabero-Almenara, Guillén-Gámez, et al., 2021) have a higher level of digital competence, whereas teachers in the area of Health Sciences present a lower level of competence (Cabero-Almenara, Guillén-Gámez, et al., 2021; Orozco-Cazco et al., 2020). In terms of age, university professors over 40 years of age score higher in the level of digital competence compared to teachers who are younger (Cabero-Almenara, Guillén-Gámez, et al., 2021).

Teaching experience; that is, the number of years in university teaching, also affects the level of digital competence perceived by the teaching staff. Indeed, teachers with less teaching experience, novices, present a higher level of digital competence than their more veteran peers (Cabero-Almenara, Barroso-Osuna, Gutiérrez-Castillo, & Palacios-Rodríguez, 2021; Cabero-Almenara, Barroso-Osuna, & Palacios-Rodríguez, 2021), considering themselves better in the areas of communication and collaboration, digital content creation, security and problem solving (Zhao, Llorente, Gómez, & Zhao, 2021).

Considering the research carried out so far on the digital competence of university professors, we can observe that it is necessary to continue studying this issue in order to adequately define specific training plans and proposals with an impact on the teacher.

This study aims to identify the level of digital competence of university teaching staff in Galicia relative to different variables: gender, university they are affiliated to, age, teaching category and area of knowledge. The Galician university system is made up of three Public Universities (The University of Santiago de Compostela, The University of Vigo and The University of A Coruña) and almost 5000 university professors. Bearing in mind that the training policies of university teaching and research staff are directly linked to the autonomy of each university and to the public policies of each autonomous community, we consider that studying the Galician case can provide complementary and relevant knowledge to case studies that are carried out in other autonomous communities.

2 METHODS

2.1 Design

The central objective of this research was to assess of the level of competence of the teaching staff in the University System of Galicia (USG) after two decades of implementation of specific training actions for the digitalization of higher education in the three universities. This information should provide a valid reference to identify training needs and guide the design of permanent training plans for the teaching and research staff. Thus, a descriptive cross-sectional study was carried out using the survey method (Cohen & Manion, 1990). To this end, an electronic questionnaire based on the DigCompEdu model published by the Joint

Research Centre of the European Commission (Redecker & Punie, 2017) was designed, as it was considered the most appropriate design and represents a current reference framework to assess this competence that is validated and accepted by the member states, and compatible with developments made in our country by the Ministry of Education and Vocational Training. This model allows us to determine the level of global digital competence, on which we will focus in this article, in addition to the six levels of digital sub-competence related to the areas that make up the instrument and that offer detailed information on the areas of improvement from the x-ray obtained.

2.2 Research Objectives

The objectives of this study were:

1. To ascertain the level of digital competence of the university teaching staff of Galicia according to the European DigCompEdu framework.
2. To ascertain and compare the level of digital competence of the university professors in the three Galician universities, attending to different areas of knowledge, classified in age ranges and considering gender.
3. To focus on the global level of TDC of the teaching and research staff of the University System of Galicia (USG) and analyze whether there are differences based on five variables: Gender (O1), Affiliated.

2.3 Sample

The population studied is composed of 4,927 teachers belonging to the USG: 1,453 belong to the University of Vigo (UVI), 2,066 to the University of Santiago de Compostela (USC) and 1,408 to the University of A Coruña (UDC). Of these, 2,602 are civil servants and 2,325 are contract staff. Data source: Sistema Integrado de Información Universitaria (SIIU), data from 2019-2020

The real sample is composed of 610 educators, from a simple random sampling, involving a statistically representative sample with a confidence level of 95% and a margin of error of 3.71%.

2.4 Information Collection Tool

The instrument used for data collection was the DigCompEdu Check-in. It was translated, adapted and validated into the Spanish context by Cabero-Almenara and Palacios-Rodríguez (2020). This instrument is composed of 22 questions representing the 6 areas of competence of DigCompEdu. In addition, sociodemographic issues linked to the context and the variables of analysis were incorporated.

The TDC questionnaire for the teaching staff of the University System of Galicia was distributed by institutional mail addressed to the deans of the three universities who in turn distributed it among all the teaching staff. The data were collected between the months of February and May 2021. The anonymity of the informants was guaranteed and all teachers were duly informed of the objectives of the study and accepted the confidentiality and data

transfer clause. The research has the approval of the BIOETHICS Committee of the USC.

3 RESULTS

51.8% of the participants are men (310) and 48.2% women (300). The average age is 51.43 years, with a minimum of 25 and a maximum of 74 years, and with an average of 21.31 years of teaching experience.

Regarding universities, 112 teachers belong to the University of A Coruña (UDC), 347 to the University of Santiago de Compostela (USC) and 151 to the University of Vigo (UVI) according to the following percentages and the distribution of the teaching and research staff among the three universities.

Regarding the professional category of the teachers surveyed, 41.8% belong to university teaching bodies and 58.2% are contracted.

As for professional categories, Figure 1 shows the participation of Social and Legal Sciences (30.98%), Arts and Humanities (21.80%), Engineering and Architecture (17.54%), Experimental Sciences (15.08%) and Health Sciences (14.59%).

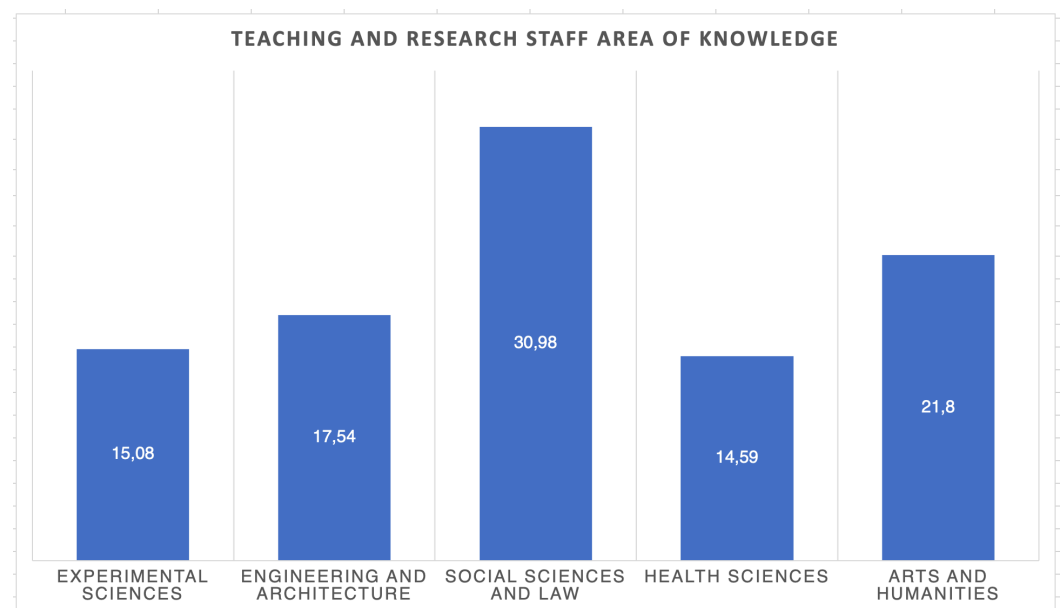


Figure 1 Teaching and research staff area of knowledge

The average level of perceived digital competence of the teaching and research staff of the USG is 42.30, which corresponds to an Integrator profile B1, representing a medium-low level in the European framework of TDC (Table 1).

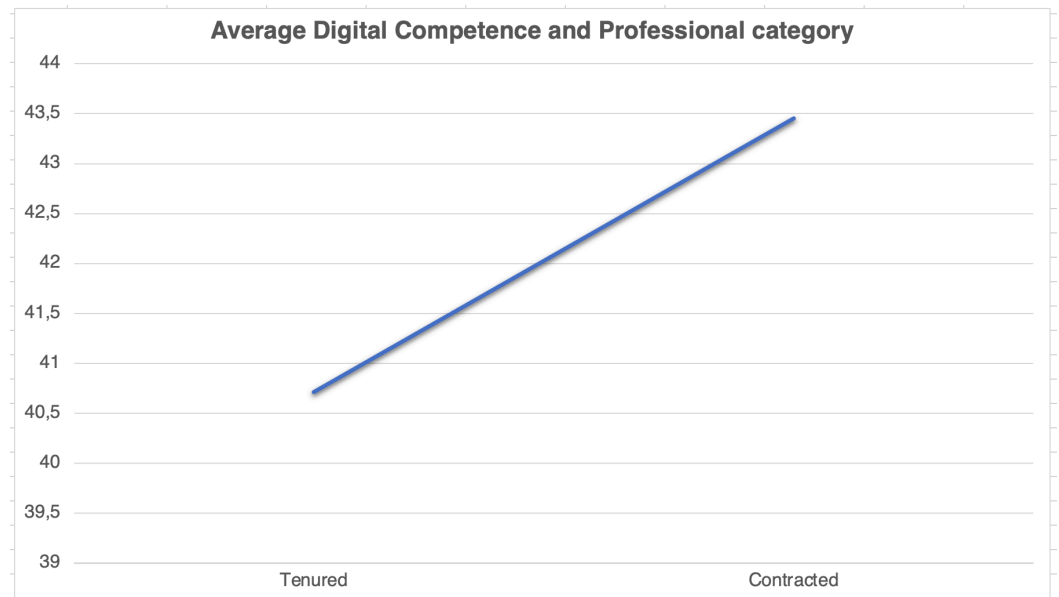
In order to find out whether there were significant differences in the level of global competence of both tenured and contracted teaching and research staff, the Student's T test was applied, formulating the following hypotheses:

Table 1 Average digital competence of the USG teaching and research staff

	N	Minimum	Maximum	Mean	Std. Deviation
Overall level of TDC	610	.00	87.00	423.066	1.358.774
N valid	610				

- Ho. There are no differences in the level of global digital competence of the USG's tenured and contracted teachers.
- Ha. There are differences in the level of global digital competence of the USG's tenured and contracted teachers.

The result of the test ($\text{sig}=.014<.05$) indicates that, although both groups are located at an integrative B1 level of competence (Figure 2), there are significant differences in the level of global digital competence of the USG tenured and contracted teachers. The average of contracted teaching and research staff (43.45) is higher than that of tenured professors (40.70).

**Figure 2** Professional category of the teaching and research staff

In order to ascertain whether there were significant differences in the level of global competence of the USG teaching and research staff according to gender, the Student's T test was applied, formulating the following hypotheses:

- Ho. There are no differences in the level of global digital competence of teachers depending on the gender variable.
- Ha. There are differences in the level of global digital competence of teachers depending on the gender variable.

The result of the test ($\text{sig}=.954>.05$) indicates that there are no significant differences depending on gender. Men scored 42.31 and women scored 42.37.

It was also interesting to find out whether there were significant differences in the level of global competence between the teaching and research staff of the three universities of the USG. To this end, a one-way ANOVA test was applied, formulating the following hypotheses:

- Ho. There are no differences in the level of global digital competence between the faculties of the three universities of the USG.
- Ha. There are differences in the level of global digital competence between the faculties of the three universities of the USG.

The result of the test ($\text{sig}=.001<.05$) indicates that there are significant differences in the level of global digital competence between the teaching and research staff of the three universities of the USG (Figure 3). Tukey's post hoc test finds significant differences between the teaching and research staff of the UDC (46.19) and the USC (40.88) while the teaching and research staff of the UDC display a higher level of competence within the same level B1 Integrator.

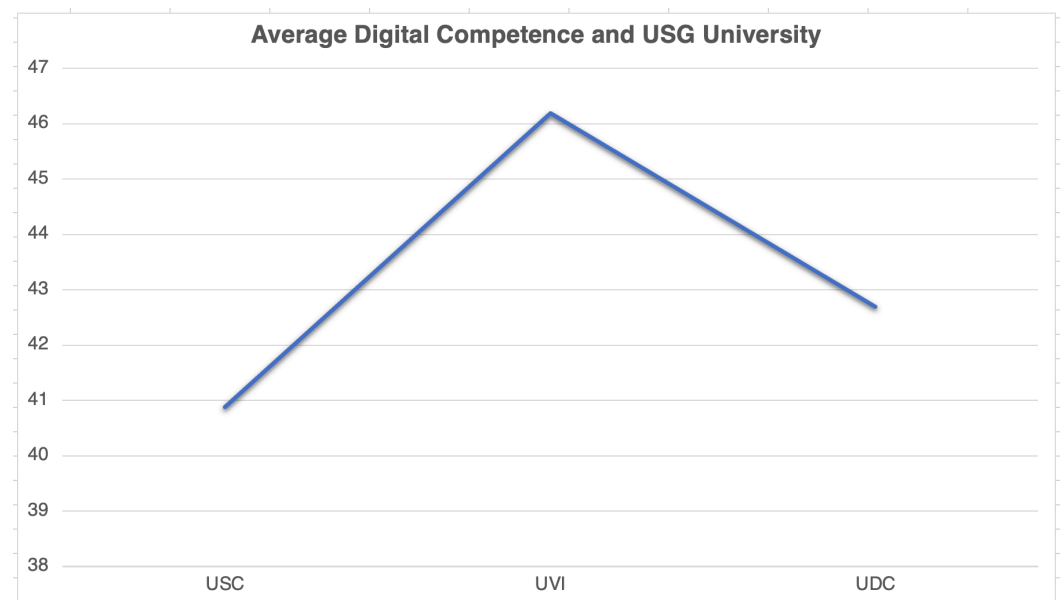


Figure 3 USG University

To ascertain whether there were significant differences in the level of global competence depending on the area of knowledge of the teaching and research staff, a one-way ANOVA test was applied, formulating the following hypotheses:

- Ho. There are no differences in the level of global digital competence of the teaching and research staff in the 5 major areas of knowledge.

- Ha. There are differences in the level of global digital competence of the teaching and research staff in the 5 major areas of knowledge.

The result of the test ($\text{sig}=.016<.05$) indicates that there are significant differences in the level of global digital competence of the teaching and research staff depending on the area of knowledge. Tukey's post hoc test displays significant differences between the teaching and research staff of Social and Legal Sciences (44.91) and the teaching and research staff of Experimental Sciences (39.53), with the former showing higher levels of digital competence (Figure 4).

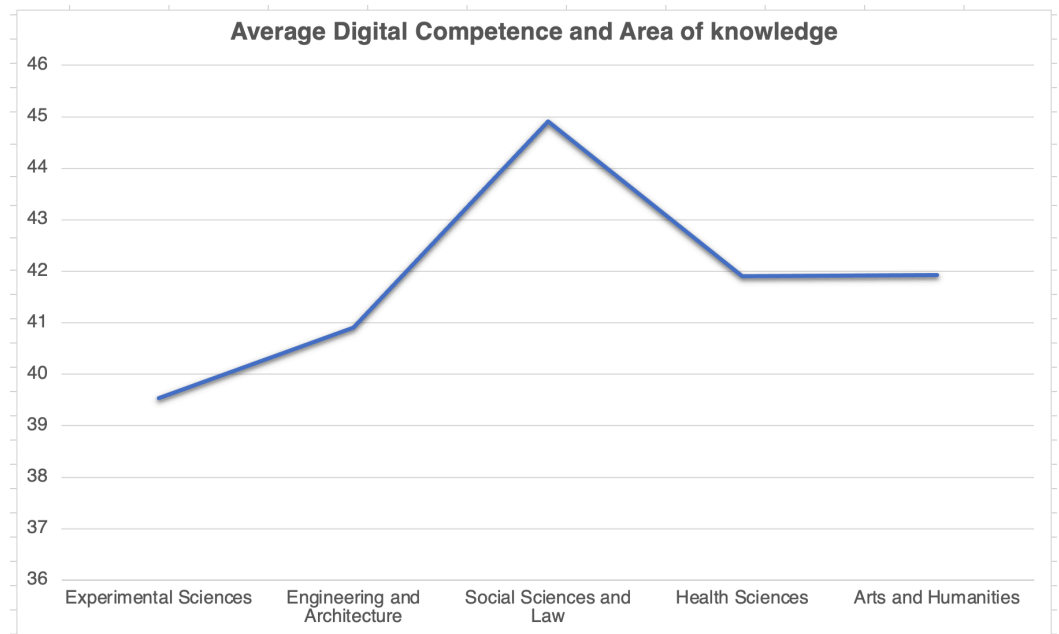


Figure 4 Teaching and research staff area of knowledge

It was also of great interest to find out whether there were significant differences in the level of global competence depending on the age of the teaching and research staff. Therefore, a one-way ANOVA test was applied, formulating the following hypotheses:

- Ho. There are no differences in the level of global digital competence of the teaching and research staff depending on age.
- Ha. There are differences in the level of global digital competence of the teaching and research staff depending on age.

The result of the test ($\text{sig}=.004<.05$) indicates that there are significant differences in the level of overall digital competence of the teaching and research staff depending on age (Figure 5). Tukey's post hoc test shows significant differences between all defined age groups, significantly decreasing the level of digital competence with the age of the teaching and research staff: 20-30 years (48.18), 31 to 50 years (44.05) and more than 51 years (40.89).

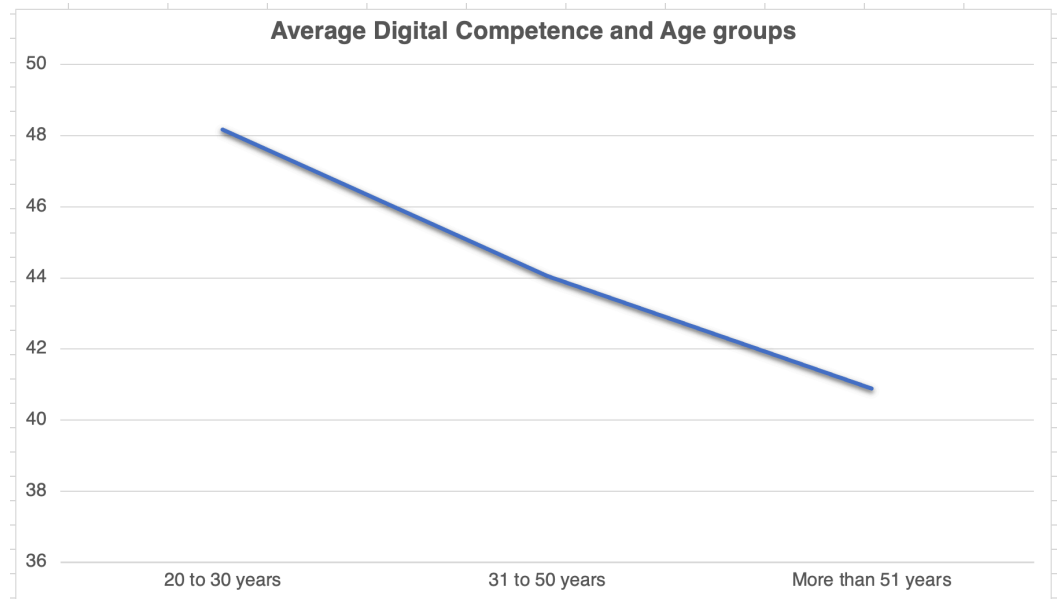


Figure 5 Age of the teaching and research staff

Finally, and in order to ascertain whether there were significant differences in the level of global competence based on the teaching experience of the teaching and research staff, a one-way ANOVA test was applied, formulating the following hypotheses:

- Ho. There are no differences in the level of global digital competence of the teaching and research staff depending on years of teaching experience.
- Ha. There are differences in the level of global digital competence of the teaching and research staff depending on years of teaching experience.

The result of the test ($\text{sig}=.000<.05$) also indicates that there are significant differences in the level of global digital competence of the teaching and research staff based on teaching experience (Figure 6). Tukey's post hoc test demonstrates significant differences between teachers with less teaching experience (with less than 5 years and between 5 and 20 years of experience) and senior teachers (with more than 30 years of teaching experience). The latter; that is, the teaching and research staff of greater seniority in universities, display a lower level of perceived digital competence: less than 5 years (45.63), between 5 and 20 years (44.47), between 21 and 30 years (41.6) and more than 30 years (38.25).

4 DISCUSSION AND CONCLUSIONS

This study reports on the degree of digital teaching competence perceived by the teaching staff of the University System of Galicia (Spain); determining their level of competence and revealing the incidence of the variables: university, professional category, gender, area of knowledge, age and teaching experience in relation to that level of competence.

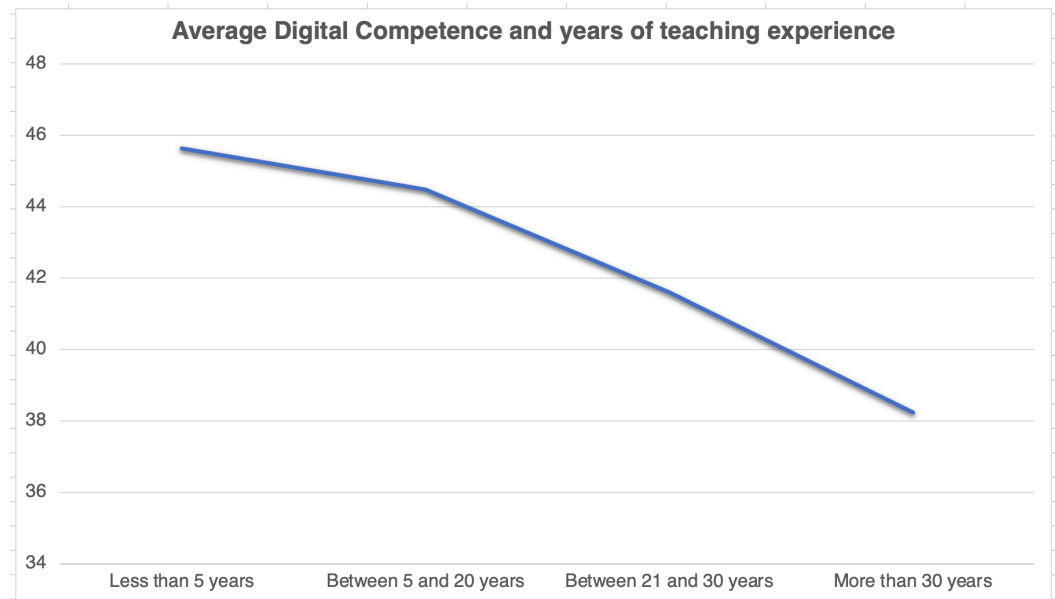


Figure 6 Years of teaching experience

The university teaching staff of Galicia has a B1-integrating profile level of digital competence (calculation determined through the system of assignment of levels collected by Cabero-Almenara and Palacios-Rodríguez, 2020). The teaching staff of the University of A Coruña obtain the highest scores within the same level. This level of competence (medium-low) is similar to that found in previous studies (Cabero-Almenara, Barroso-Osuna, Gutiérrez-Castillo, & Palacios-Rodríguez, 2021; Cabero-Almenara, Guillén-Gámez, et al., 2021; Esteve-Mon et al., 2020; Guillén-Gámez, Mayorga-Fernández, & Contreras-Rosado, 2021). Universities have implemented specific teacher training plans for more than two decades, among which we can highlight recurrent actions related to digitalization. This underlines that the success of these plans has been limited and that they need redefining, taking as a reference the frameworks and pedagogical proposals on what it means to be a digitally competent teacher developed for this purpose (Prendes et al., 2018). It seems reasonable that academic knowledge about this area supports the policies and teacher training plans of universities, and these are not based on trends and fashions, commercial interests or untested assumptions. The prevailing instrumental approach in the aforementioned plans, its minimal link to teaching practice and its focus on technology and its technical management are insufficient to develop teaching competencies guaranteeing the set of attitudes, knowledge and skills necessary for teaching. The differences depending on the ages and teaching experience of the teaching and research staff also highlight the need for more personalized training plans (Cejás-León & Gámez, 2018), to focus on pedagogy (Espinar, 2020) and to exceed the dissemination of basic literacy courses that have previously focused on technical issues (Fernández & Pérez, 2018).

This research also reveals that there are significant differences with respect to the level of global digital competence of tenured and contracted teaching staff in the University System of Galicia, where the average of the contracted teaching staff is higher. This datum is novel and could be interpreted as the result of the realization of a greater number of training activities aimed at the acquisition of digital competence and that are recognized in accreditation and job promotion processes. These results cannot be contrasted with other research since they have not been previously demonstrated, but they should be taken into account in the planning of training actions and in the systems and criteria of evaluation of teaching activity and professional incentives.

Regarding gender, it is again evident that this is not a factor relevant to the level of digital competence of university professors, a fact that is in line with previous research [Basantes-Andrade et al. \(2020\)](#); [Cabero-Almenara, Barroso-Osuna, Gutiérrez-Castillo, and Palacios-Rodríguez \(2021\)](#); [Cabero-Almenara, Barroso-Osuna, and Palacios-Rodríguez \(2021\)](#); [Guillén-Gámez, Mayorga-Fernández, and Bravo-Agapito \(2021\)](#); [Trujillo and Flores \(2021\)](#). However, it is pertinent to indicate that other studies show that gender moderately affects the level of digital competence of teachers, tending to have a negative effect, specifically in the case of women ([Guillén-Gámez, Mayorga-Fernández, & Contreras-Rosado, 2021](#)). This diversity of results requires a multivariate approach to further analyse the issue.

This study shows that there are significant differences in the level of global digital competence of teachers depending on the area of knowledge. The tests carried out report that the teaching staff of Social and Legal Sciences are those with the highest level of competence, while the teachers of Health Sciences are those who perceive that they have a lower competence. Similar results were reported in a previous study ([Cabero-Almenara, Guillén-Gámez, et al., 2021](#)), in which it was also identified that teachers of Social and Legal Sciences have a higher level of competence. It should be noted that the lower level of digital competence of teachers in the area of Health Sciences has also been described in the literature ([Cabero-Almenara, Guillén-Gámez, et al., 2021](#); [Sánchez & Rodríguez, 2021](#)).

It is also worthy of mention that the level of competence of the teaching staff of Galician universities decreases as age increases. Indeed, the study shows that teachers between 20 and 30 years old are those with the highest level of competence. These data are in line with those found in previous studies, in which it has been reported that the perception of digital competence is higher in the group of younger teachers, characterized according to the literature by their familiarity and confidence in relation to technology ([Gallardo-Echenique, Acevedo, & Esteve-Mon, 2018](#)). However, it does not coincide with results in other studies ([Cabero-Almenara, Barroso-Osuna, Gutiérrez-Castillo, & Palacios-Rodríguez, 2021](#); [Cabero-Almenara, Guillén-Gámez, et al., 2021](#)) in which it is stated that the teachers with the highest level of digital competence are those between 30 and 49 years old. This relationship should also be studied further with tools for evaluating competence in contexts and real cases in order to identify the extent to which self-perception and generational affinity with respect to technologies may be influencing these results.

In line with other research ([Zhao, Llorente, & Gómez, 2021](#)), the teaching experience of Galician university professors reveals significant differences favoring less experienced

teachers. However, disparate findings are found in relation to this matter. On the one hand, Santos-Lorenzo and Martínez-Abad (2021) report that teachers who have more experience in teaching perceive that they have a higher level of digital competence. On the other hand, Cabero-Almenara, Barroso-Osuna, Gutiérrez-Castillo, and Palacios-Rodríguez (2021) state that teachers with an experience of between 4 and 14 years have a higher level of digital competence than their peers.

In light of the results of this study, it can be concluded that the digital teaching competence of Higher Education teachers is a matter of vital importance for improving the quality of university teaching and for the strategic positioning of public universities in Galicia, which cannot be treated as an exclusively technical but, rather, a pedagogical issue. Indeed, the development of teachers' digital competences can foster a paradigm shift in educational and pedagogical system in universities, as well as in learning outcomes (López, Burgos, Branch, & Younes-Velosa, 2020) and in the improvement of students' competences (Núñez-Canal, Obesso, & Pérez-Rivero, 2022).

The design of proposals must be based on previous assessments (Lucas, Dorotea, & Piedade, 2021; Sillat, Tammets, & Laanpere, 2021) and attend to competency frameworks. From there, we can understand and articulate the knowledge and professional competences of teachers (Hidson, 2021). The training programs must improve the digital competence of the teaching staff. They must have a strong pedagogical foundation and strategic planning so that, thanks to personalized and updated itineraries, they can respond to the demands and needs of the university teaching staff of the different areas.

The pandemic caused by COVID-19 has revealed shortcomings in the teacher training policy (Cabero-Almenara, Guillén-Gámez, et al., 2021; Villar, Herrero, López, & G, 2022) and Galician universities urgently need a teaching and research staff training proposal for the digitalization of rigorous, systematic teaching aimed at the promotion and evaluation of teaching skills, not the exclusive management of applications and technologies. The digital competence training of "post-covid-19 era" teachers must be supported by and focused on teaching practice, with expert advice and personalized methodological support in the innovative activities carried out by the teaching staff. The emphasis of the intervention should change radically from technology to the teacher and the activity being performed to facilitate the learning of students. It should consequently move away from the design of unconnected teacher training courses determined by unsubstantiated pedagogical criteria.

5 AUTHORS' CONTRIBUTIONS

Conceptualization, C.F.-M., B.C.L., L.C.-O. and F.M.L.; methodology, C.F.-M., B.C.L. and L.C.-O.; software C.F.-M.; validation, C.F.-M., B.C.L., L.C.-O. and F.M.L.; formal analysis, C.F.-M.; investigation, C.F.-M., B.C.L. and L.C.-O.; resources, B.C.L. and F.M.L.; data curation, C.F.-M.; writing—original draft preparation, C.F.-M., B.C.L., L.C.-O. and F.M.L.; writing—review and editing, C.F.-M., B.C.L., L.C.-O. and F.M.L.; visualization, C.F.-M. and B.C.-L.; supervision, C.F.-M. and B.C.L.; project administration, C.F.-M., B.C.L. and L.C.-O. All authors have read and agreed to the published version of the manuscript.

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